



Cultural Group Selection and the Evolution of Reindeer Herding in Norway

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Abstract

Herding can be characterized as a coordination game with two strategies for minimising risk: increase herd size (livestock *quantity*) or increase livestock body mass (livestock *quality*). In this paper I demonstrate that the selection of herd maximisation as a risk management strategy in the Northern parts of Norway has been influenced by a history of intra-group competition exacerbating herder conflict and lack of trust. In the South herder-farmer conflicts have increased herder coordination and trust, resulting in the selection of increasing livestock quality as the dominant risk management strategy.

Keywords Group selection · Reindeer herding · Nomadic pastoralism · Norms · Competition · Cooperation · Norway

Introduction

The debate about reindeer husbandry in Norway is characterised by two contrasting views. On one hand is the prevailing view of overstocking. The Office of the Auditor General of Norway has suggested that pasture in Northern parts of Norway (Finnmark) is overused: in 2009 > 50% of the lichen cover was overgrazed while ~40% of the lichen cover was reduced (Office of the Auditor General 2012). Furthermore, in 2010 a news story reported that reindeer were starving to death on the way to winter pastures (Aslaksen and Måsø 2010), a time they should be in good condition after gaining body mass during the summer (cf. Bårdsen *et al.* 2010). Previously, starvation occurred during harsh spring/early summer (Hausner *et al.* 2011) when reindeer were in poor condition after losing body reserves during the winter (cf. Bårdsen 2017). Consequently, the primary objective of the Norwegian Government with respect to management of reindeer husbandry is to achieve ecological, economic, and cultural sustainability through reducing the number of reindeer, because both

economic and cultural sustainability are assumed to depend on ecological sustainability (Ulvevadet 2012).

On the other hand, Benjaminsen *et al.* (2015) argue that the current debate around overstocking and overuse represents a misreading of the Arctic landscape and perpetuates a dominant crisis narrative that functions as “... an enduring ‘social fact’, whose narrative reality is in large part decoupled from its supposed scientific basis” (Benjaminsen *et al.* 2015:228). This narrative affects policies and fails to incorporate both alternative scientific evidence and interpretations in line with non-equilibrium ecology, i.e., livestock and pastures are limited by external factors such as climate (cf. Little *et al.* 2001; Næss 2013). Thus, the debate is flawed because a non-equilibrium system is “... where herbivore populations fluctuate randomly according to external influences, [and] the concepts of carrying capacity and overgrazing have no discernible meaning” (Benjaminsen *et al.* 2015:223).

The Importance of a Comparative Perspective

The overstocking and non-equilibrium view is limiting because it equates reindeer herding in Norway with reindeer herding in Finnmark. While >70% of Norway’s Saami reindeer herders operate in Finnmark, it is not necessarily representative of reindeer herding in Norway. Herding in Finnmark (hereafter: North) can be characterized by increasing reindeer abundance and low rates of slaughter (as well as low reindeer body mass), whereas in South-Trøndelag/Hedmark (hereafter: South) it is characterized by relatively stable herd abundance,

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high rates of slaughter, and high body mass (Fig. S1.1). Surprisingly, important environmental conditions are similar since both regions have access to winter pastures with a cold, stable, and favourable climate (Tveraa *et al.* 2007).

A pertinent question is thus why—if fluctuations in herd abundance in the North are natural and characteristic of a non-equilibrium system (Benjaminsen *et al.* 2015)—has herd abundance in the South been comparatively stable? Or, as Riseth (2000) asks: why is it the case that the area having the best conditions for reindeer—with safe and stable lichen pastures—is exposed to the most serious problems?

The contrast between the North and South can be understood by a historical comparative analysis of how different historical perturbations have resulted in different outcomes. I demonstrate that in the North, the most significant historical perturbation has been related to border closings cutting across and contracting important and established trans-national migration routes and grazing areas. In the South, there has been an expanding and a favoured agricultural sector encroaching upon traditional reindeer areas. Thus, while competition over decreasing pasture areas has characterised the history of herding in both the North and the South, in the North it has been and remains between different groups of herders (or individual herders, i.e., intra-group) while in the South it has been and remains between herders and farmers (i.e., inter-group). By framing reindeer herding as a coordination game with two strategies for managing risk: (1) *maximising quantity* (i.e., increasing livestock numbers or herd size), and (2) *maximising livestock quality* (i.e., increasing livestock body mass), I demonstrate that intra-group competition has led to the adoption of (1) in the North, while inter-group competition has led to the adoption of (2) in the South.

Reframing Nomadic Pastoralism as a Coordination Game

Reindeer herding management policies in Norway rest on the understanding it can be characterised as a ‘Tragedy of the Commons’ (Hardin 1968). As Hardin noted, ‘Prisoner’s Dilemma’ problems occur in many, if not most, situations that call for collective sacrificial restraint or action (Wydick 2008). For example, individual conservation of common-pool resources, such as forests, fisheries, and grazing lands, typically yields a total public benefit compensating everyone for his/her own restraint. Nevertheless, the inherent social dilemma is that the underlying incentive rests on gaining individual advantage through a lack of individual restraint (Wydick 2008).

Herding is, however, better conceptualized as a *coordination game* where players have common interests: benefits accrue to individuals through collective action and individuals

are better off cooperating (Alvard and Nolin 2002). The problem is that of coordination: the assurance game used as a starting point here has two Nash equilibria¹—both cooperate or both defect—but only one Pareto optimal solution² - both cooperate (Alvard and Nolin 2002); whereas a Prisoner’s Dilemma has only one Nash equilibrium - both defect (Fig. 1).

Following Dyson-Hudson (1977), the ultimate goal of pastoralists is the survival of the pastoralist and his/her family. Any proximate goal must thus be viewed with reference to the ultimate goal of survival. For nomadic pastoralists, herd accumulation is an efficient strategy for buffering environmental variation since herders with large herds have comparably larger herds over time, both before and after periods of crisis (cf. Næss and Bårdsen 2010; Næss *et al.* 2011; Næss and Bårdsen 2013; Næss and Bårdsen 2015). In short, herd maximisation is a proximate goal that has a positive effect on the ultimate long-term goal of household survival. Nevertheless, it could be argued that the best risk management strategy is to increase livestock body mass rather than herd size because it offsets the effects of density-dependence: high reindeer abundance results in smaller animals that are more vulnerable to unfavourable conditions (cf. Bårdsen 2017; Tveraa *et al.* 2003).³ Moreover, while herd accumulation has been found to be efficient it is also costly (Næss and Bårdsen 2013). Herding can thus be heuristically conceptualized as a two-person coordination game where the decision is to buffer risk through maximising either livestock quantity or quality (Fig. 1).

Norms as Coordination Devices

In a coordination game with two and more Nash equilibria players can have difficulty deciding on which to choose. If some clue can lead the participants to believe that one choice (equilibrium) is more likely to be realized than another, the more likely one is called a Schelling point or focal point (McCain 2003). Schelling (1980) argued that it is the salience or prominence of focal points that draws people to them, and that what is salient depends on the time and place and who the players are (McCain 2003; see also Sugden 2005). Alvard (2003) conceptualises focal points as norms, i.e., regularities of behaviour maintained through shared ideas of right and wrong that can facilitate coordination (see also Ensminger and Knight 1997). Norms can thus be viewed as conventions

¹ No player can do better by choosing another strategy if the other player(s) continue to pursue the already selected strategy (McCain 2003).

² A state of affairs is Pareto-optimal (or Pareto-efficient) if and only if there is no alternative state that would make some people better off without making anyone worse off (<https://www.britannica.com/topic/Pareto-optimality>).

³ Reindeer populations are limited by how both environmental conditions (climate) and negative density dependence affect body mass: small individuals are less likely to reproduce, are older when they do, and produce offspring with low life expectancies, vulnerable to starvation and predation, (cf. Bårdsen 2017)

General payoff matrix		P2	
		Cooperate	Defect
P1	Cooperate	Reward, Reward	Sucker, Temptation
	Defect	Temptation, Sucker	Punishment, Punishment

Prisoner's Dilemma		P2	
		Cooperate	Defect
P1	Cooperate	3, 3	0, 5
	Defect	5, 0	1, 1

Assurance Game		P2	
		Cooperate	Defect
P1	Cooperate	5, 5	0, 1
	Defect	1, 0	3, 3

Fig. 1 General characteristic of a Prisoner's Dilemma is that it consists of two or more players who are each able to engage in either "cooperative" or "defecting" behaviour. Each player benefits from the cooperative play of others, but individually each have an incentive to defect. Because each player is better off defecting—regardless of the behaviour of the others—the game yields a unique Nash equilibrium in which all defect and are worse off than if each player had played cooperatively (because of the payoff structure: 'Temptation' > 'Reward' > 'Punishment' > 'Sucker'). In other words, while the Pareto optimum is for both players to cooperate, this is not a Nash equilibrium. Rather than a Prisoner's Dilemma, herding can be heuristically conceptualized as a two-person coordination game where the decision is to decide whether to buffer risk through (1)

of coordination, e.g. 'keep left' or 'keep right,' that evolve from repeated iterations (Sugden 2005). Norms reduce transaction costs⁴ and provide assurances of satisfactory payoffs for participants. The cultural transmission of norms can thus be viewed as the "pregame" communication crucial for achieving the best outcome (Alvard and Nolin 2002:522).

Cultural Group Selection and the Evolution of Norms

Gurven (2004) argues that among foragers norms eliminate the collective action problem of, for example, group food production. Nevertheless, enforcing norms is a second-order collective-action problem for which one theoretically viable solution is, according to Smith (2004), cultural or genetic group selection because cooperation within groups can evolve when groups compete (Brooks *et al.* 2018).

⁴ Transaction costs include: (1) search costs, i.e., identifying possibilities for cooperation; (2) bargaining costs, i.e., agreeing on one form of cooperation rather than another; and (3) monitoring and enforcement costs, i.e., ensuring that the cooperation of other members is enforced (Mearns 1996, see also Alvard and Nolin 2002).

increased herd size (quantity) or (2) increased livestock body mass (quality). The payoff structure is: 'Reward' is the payoff for increasing livestock quality. 'Temptation' is the payoff obtained when a player defects to increase quantity while his partner solitarily pursues quality for a payoff of 'Sucker.' 'Punishment' is the payoff of herd maximisation for both players. If 'Reward' > 'Temptation' (increasing livestock quality provides greater utility with respect to long-term household survival or viability than herd maximisation), herders should share the preference to increase quality rather than herd size, since it is a Pareto optimum, although both increasing livestock body mass and herd size are Nash equilibria

Competition between culturally different groups has been argued to shape normative content (Boyd *et al.* 2018). Collective norms and values could affect the probability of a group's survival, whether it is economically successful, expanding, or imitated by its neighbours (Boyd and Richerson 2009). Groups with more successful cultural traits are thus more likely to pass those traits to the next generation (Zefferman 2018). In short, inter-group competition is an important factor for spreading pro-social or cooperative norms and inter-group competition can thus shape cultural evolution (Francois *et al.* 2018; Henkel 2018). Turchin (2007:6) argues that in environments characterised by intense inter-group competition "... poorly integrated groups crumble and disappear, whereas groups based on strong cooperation thrive and expand." The domination of one group over another is made possible because it is integrated by cooperation (Turchin 2007).

Regional Differences in the Development of Reindeer Herding

Reindeer husbandry developed as a pastoral economy at least 400 years ago and probably evolved from a hunting culture based on wild reindeer (cf. Næss and Bårdsen 2013). From a

national point of view, the Saami reindeer husbandry is a relatively small industry: consisting of 538 *siida* shares (administrative units) and 3307 affiliated people. Nevertheless, reindeer husbandry is locally important both economically and culturally. Moreover, around 40% of Norway's landmass is utilized by reindeer herders (for more details see Næss and Bårdsen 2013, Text S1).

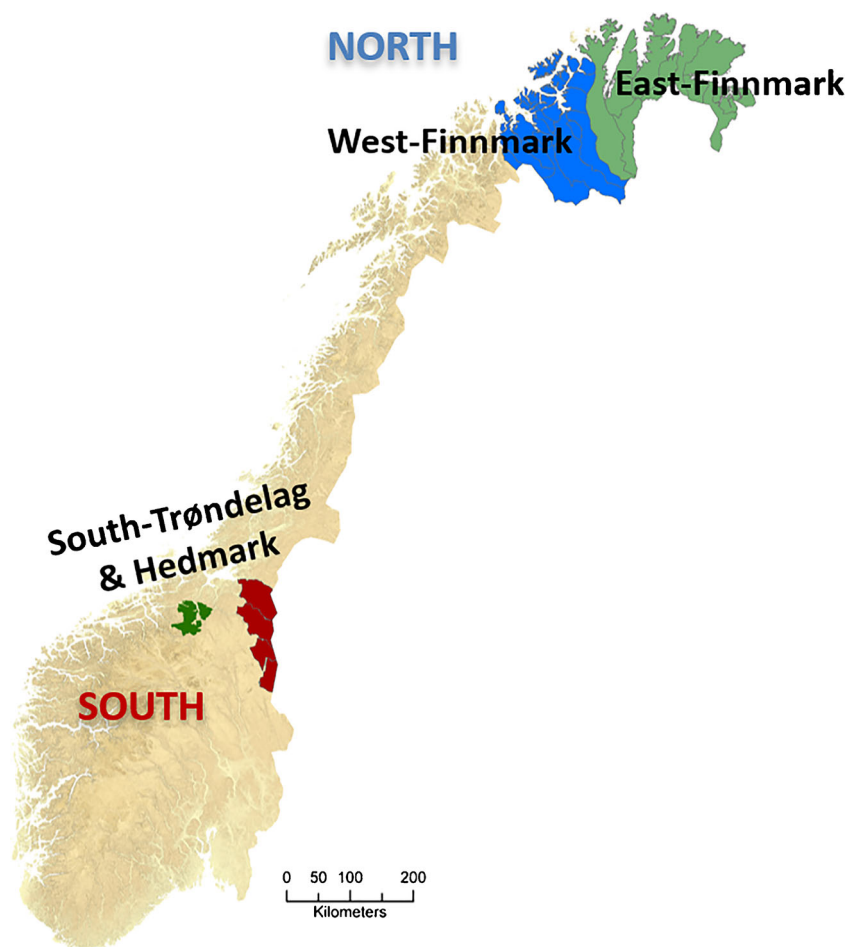
Saami reindeer herders' social organisation is comprised of three layers. The basic unit is the *siida* share: a license granted by the government entitling the owner to manage a herd of reindeer within a designated area. One or more license owners belong to *siida* (North) or *sijte* (South; but official designation is *siida*), which is a cooperative herding group traditionally composed of households related through kinship (*siidas* can also include non-kin). There are 99 summer *siidas* and 150 winter *siidas* in Norway (Norwegian Agriculture Agency 2016: 23). *Siidas* are grouped into districts: formal administration units defined by the government (cf. Næss and Bårdsen 2013, 2015).

The North, which comprises the East and West-Finnmark pasture area, has ~70% of the reindeer husbandry in Norway (Fig. 2). The area is divided into six

zones (Norwegian Agriculture Agency 2016: 16). West-Finnmark is separated into three migratory systems: Kautokeino Eastern Zone, Middle Zone, and Western Zone. In East-Finnmark, Karasjok Eastern Zone and Western zone are also naturally separated migratory systems. Further east is Polmak/Varanger zone (Norwegian Agriculture Agency 2016). There are 23 summer districts in West-Finnmark (plus an additional three from Troms utilising winter pasture in West-Finnmark) and three winter pastures (Norwegian Agriculture Agency 2016). In East-Finnmark there are 12 summer districts and one spring/autumn/winter pasture area (ibid.).

The South, which comprises the South-Trøndelag and Hedmark pasture area, is the southernmost reindeer pasture area in Norway and herding is distributed among five different reindeer districts: Saanti *sijte* (Norwegian: Essand), Gåbrien *sijte* (Norwegian: Riast/Hylling), Svahken *sijte* (Norwegian: Elgå), and Trollheimen (Fig. 2). In addition, there is a common winter pasture area—Femund—utilised by Saanti and Gåbrien *sijte* (Fjellheim 1999; Gundersen and Rysstad 2013; for more details concerning the North-South designation, see Næss and Bårdsen 2015; Riseth *et al.* 2004).

Fig. 2 The North (Finnmark) and the South (South-Trøndelag/Hedmark) reindeer pasture areas



Reindeer Herding in the North

Until 1933 reindeer herding in the North was regulated differently from the rest of Norway and held a special position (S1). At the end of the eighteenth and beginning of nineteenth centuries the government had a more positive attitude towards the reindeer husbandry in the region (Holand 2003), and Saami herders from Kautokeino and Karasjok extended their winter migrations far into the forests of present-day Finland. At the same time, herders from parts of Northern Finland had summer pastures on the Norwegian side of the border.

In 1852 the border between Finland and Norway was closed for reindeer (Holand 2003), limiting cross-border access to grazing areas (Marin 2006). The lack of Finnish winter pastures led to the deterioration of Norwegian lichen pastures due to increased use (NOU 1994). The border between Sweden and Finland continued to be open for reindeer and to maintain access to Finnish winter pastures several Saami families migrated to Sweden, some even became Swedish citizens. The influx of “Norwegian” Saami displaced “Swedish” Saami, who moved further south in Sweden (Holand 2003).

The first regulations to establish new patterns of usage came into effect in Norway in 1853 (Holand 2003) and banned grazing reindeer in Inner Finnmark during summer. Increasing conflicts between herders from Kautokeino and Karasjok led to the allocation exclusive winter pasture areas, and in 1871 a ‘buffer’ zone between them was also established (Fig. S1.2).

In 1889 the border between Finland and Sweden was closed to reindeer herding. Subsequently, several Kautokeino Saami who had emigrated to Sweden moved back to Norway (Aarseth 1989:74). In 1888 another law further regulated pasture use: summer pastures were distributed among Kautokeino, Karasjok, and Polmak/Varanger (Aarseth 1989). This distribution relocated the previous ‘buffer’ zone between Kautokeino and Karasjok to Kautokeino (Holand 2003; Aarseth 1989).

The Reindeer Husbandry Law of 1933 stipulated district division in the North. Finnmark county was, however, divided not only into districts but also into parishes (Norwegian: *reinsogn*, Marin and Bjørklund 2015). In 1934 the County Governor in Finnmark finalised the distribution of pastures through dividing summer pastures as well as common spring and fall pastures into separate districts (Holand 2003; Marin and Bjørklund 2015; Fig. S1.3).

In West-Finnmark the number of reindeer fluctuated around 40,000 until the 1970s, but by 1990 the number had increased to about 110,000. According to Marin 2006 the increasing abundance in the North was caused by increased mechanisation in the mid-1960s and the introduction of

governmental subsidies. The post-war social changes in the North changed the migratory patterns and resulted in gradual sedentarisation of herders (Holand 2003; Riseth and Vatn 2009). Moreover, Holand (2003) argues that by the end of the 1970s the introduction of modern technology, a cash economy, and the relatively large sums of the government subsidies had weakened the traditional patterns of use of autumn and winter pastures. At the same time, the number of herders increased (S1).

During the 1980s inter-siida conflicts increased and traditional siida-borders were challenged (Holand 2003: 200; Marin 2006). Holand (2003) attributes the increasing conflict level to the fact that expanding siidas opportunistically argued that the district designation of 1934 had designated autumn and winter pastures as ‘commons’ (Marin (2006) argues that this designation occurred with the 1978 Act). Traditionally, long-term use of specific pastures had established reciprocally recognized rights in space and time; but there was rarely full exclusivity as siida areas all overlapped to some extent. Paine (1994: Fig. 5.7) argues, for example, that while herds graze on physically separated areas during summer, winter pastures constitute an overlapping quilt. Neighbours were usually well-aware of traditions and rights, knowing under which conditions the use of others’ pastures could be acceptable (Riseth and Vatn 2009). By designating winter and autumn pastures as ‘commons’ a de facto situation of open access to winter pastures was created (Marin 2006). Marin and Bjørklund (2015:23–4) argue:

“It was the first time a legal text implied that any existing divisions between groups were superseded, indeed that the ‘traditional’ way of managing these territories was some sort of collective (*felles*) use that gave equal rights to individuals by virtue of their simple membership to an undefined collective.”

As Holand (2003) points out, a siida wanting to expand must extend its grazing area. But territorial expansion of one siida will often be considered as trespassing by other siidas (Marin and Bjørklund 2015), and thus will trigger conflicts with respect to traditional use (unless one party withdraws). This strategy of expansion was used by the so-called ‘inner’ siidas/districts (i.e., siidas/districts that are closer to the autumn and winter pastures and thus have an advantage during fall migration): from 1980 to 1990 they increased their herds by an average of 130% while the ‘outer’ districts (i.e., coastal and island districts) only increased by 38% (Riseth and Vatn 2009:98).

Neighbouring siidas in conflict over territory may impose sanctions on each other, ranging from withholding information to slaughtering the most valuable females (Riseth and Vatn 2009; see also Paine 2009). At the same time, herders accept that “lucky” reindeer owners experiencing increased herd size need larger pastures. This is, however, constrained by an important caveat: expansion should not be at the

expense of the original users (Marin and Bjørklund 2015). With the designation of winter pastures as “commons,” accusations of encroachment became widespread (Marin and Bjørklund 2015).

Not surprisingly, Hausner *et al.* (2012) found that in the North there is a low level of trust and cooperation between siidas. This is especially evident on the winter pastures where 52% of their respondents ($n = 74$) are suspicious of their neighbours, while only 19% reported a strong degree of trust towards their neighbours (p. 4). In contrast, on summer pastures trust is high: most summer pastures are managed by one siida whose members have strong family ties with a long history of collaboration (*ibid.*).

Marin (2006), argues that individualized reindeer herding through legal permits vested in individual herders—the siida share licences—is eroding the cooperative nature of reindeer herding. Through the reindeer licence “... herders did not need the approval of the herding community at large anymore and could pursue their own interests” (p. 217). While Paine (2009:123) argues “... that inter-camp [siida] are the loci of changing, and at times uneasy, combinations of trust and suspicion,” and the introduction of the reindeer license could result in an erosion of trust between members of the same siida.

A case in point is the example of the young reindeer herder Jovvset Ante Sara.⁵ Briefly, the Norwegian Government has demanded that he must reduce the number of his herd from 116 to 75 animals (35%; Hætta 2018). The demand stems from a united Norwegian Parliament supporting enforced slaughter to reduce the number of reindeer in the North (Larsson and Ballovara 2013). The case has moved through the Norwegian courts for several years, ending with the Supreme Court adjudicating in the favour of the Norwegian Government on the 21st of December 2017 (Larsen 2018). Because of the apparent difficulties with making a living with just 75 reindeer, Sara has submitted his case to the European Court of Human Rights (Nordvåg 2019).

The background, however, seems to indicate that this is a case that has been influenced by intra-siida (or district) coordination issues, since it was the district that had been originally tasked with reducing the number of reindeer (from 3105 to 1700; Larsen 2018). The problem arose, however, when the siida-shares within the district failed to agree upon how to distribute the reductions among themselves. The Reindeer Husbandry Board⁶ subsequently ordered everyone within the district to reduce their number by 35% (Hætta 2018; Larsen 2018). According to the Director of Reindeer Husbandry of the Norwegian Agriculture Agency, this did not necessarily mean that each herder would be required to

slaughter 35% of their herd since the district as a whole could still re-allocate reindeer numbers among individual siida-shares as long it reduces the number of reindeer to within the maximum allowed (Hætta 2018). In general, internal allocation of cuts has been problematic because only three of the 44 districts ordered to reduce their overall number of reindeer managed to agree internally (compounding the issue is the fact that internal agreement requires unanimity; Nordvåg 2019). In 2013, 231 siida-shares had received orders of reindeer reduction from the Ministry of Agriculture and Food, and by 2019 everyone had complied except Sara (Nordvåg 2019).

The Norwegian Broadcasting Corporation (NRK) interviewed 20 out of 27 district leaders in West-Finmark and found all but one agreed that the reductions were necessary (Nordvåg 2019). With respect to Sara’s case: nine leaders supported him, six thought he should reduce his herd, and two pointed out that it was his own district that should have been brought before the court because the situation was the result of an internal conflict (other leaders declined to express their opinion; Nordvåg 2019).

In sum, the history of reindeer herding in the North demonstrates that the most significant historical constraint on reindeer herding has been related to border closings cutting across and contracting important and established trans-national migration routes and grazing areas. This has been translated to increased conflict between herders or groups of herders, i.e., increased intra-group competition (Fig. 3; see S1 for more details).

Reindeer Herding in the South

While a district division was not formalised in the North until the Reindeer Husbandry Law of 1933, in the South, districts were established by Royal Resolution as early as in 1894 (Fjellheim 1999), principally to protect farmers from damages incurred by reindeer. In effect the aim was not to provide herders with grazing rights but rather to provide stronger control while at the same time ensuring damage compensation for the sedentary population (Gundersen and Rysstad 2013). Thus, in the South there has been a long history of herder-farmer conflicts, driven mainly by an expanding agricultural sector.

In both 1794 and 1801, for example, Saami herders had written complaints to the county pointing out that farmers were trespassing on their traditional summer grazing areas (Fjellheim 1999). Furthermore, these complaints indicate that farmers had violently threatened herders, threatened to kill their reindeer, and stolen Saami property (Fjellheim 1999). While the herders got their stolen property back that farmers were not punished for their misdeeds on either occasion (S1).

However, the herders were punished for illegal grazing (*ibid.*). Subsequently, in 1875, 1876 and 1877, five farmers

⁵ A case that has had international coverage, e.g., in the New York Times in 2018 (<https://www.nytimes.com/2018/12/16/world/europe/reindeer-norway-sami.html>).

⁶ Serves as a professional adviser to the Norwegian Agriculture Agency (§ 71 of the Reindeer Husbandry Law 2007).

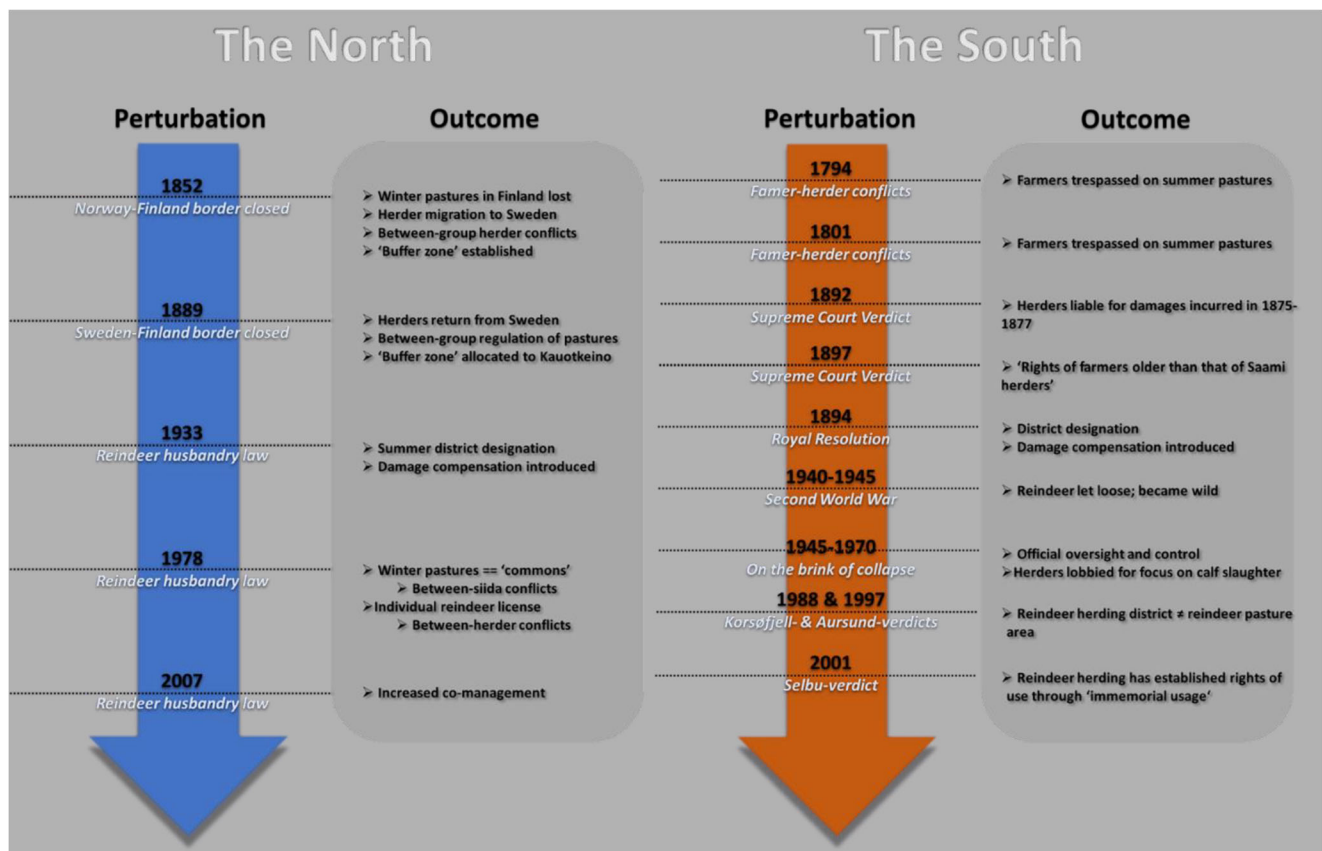


Fig. 3 Historical perturbances and their effects on reindeer herding in the North and South. Maximising herd size (quantity) in the North is primarily caused by increasing herder-herder competition (intra-group competition) in an environment characterised by increasing pasture

brought a lawsuit against the Saami because their reindeer had 'damaged their summer farms and hayfields' (ibid.:127). A final verdict was reached after 15 years by the Supreme Court on the 7th of April 1892, which sentenced the Saami herders to pay for damages the farmers claimed they incurred (Fjellheim 1999). Just five years later, in 1897, another Supreme Court verdict bluntly stated that 'research has shown that the rights of farmers are older than those of the Saami' (ibid.:138).

In general, already established farms had summer mountain pastures/summer farms in nearby areas. After a while, they became permanent farms that again required their own summer farms and areas for haymaking and other purposes on (Fjellheim 1999). These were often established in traditional Saami summer areas because reindeer milking sites, which had been fertilized by reindeer droppings, provided good sites for haymaking and were thus excellent locations for the establishment of new farms (Fjellheim 1999).

During the Second World War and its aftermath the reindeer in the South became, according to Holand (2003), more or less feral. During the war, herders let the reindeer roam free so that the German soldiers could not slaughter them (Gundersen and Rysstad 2013). Post-war, the distribution of

limitations. Maximizing livestock body mass (quality) in the South is caused by increasing herder-farmer competition (inter-group competition) in an environment characterised by increasing pasture limitations (see main text and S1 for details pertaining to the perturbations)

unmarked reindeer became contentious: herders struggled with control and unmarked reindeer often migrated outside official district borders (Skjenneberg and Slagsvold 1968). Subsequently, the County Governor declared previous reindeer herding areas as wild reindeer areas where hunting was allowed (Holand 2003). This increased the level of tensions between herders and landowners, and even within the reindeer district borders hunting of un-herded reindeer was allowed. According to Gundersen and Rysstad (2013), reindeer herding in the South was not regulated until the 1970s. Thus, from the end of the Second World War until the 1970s the prevailing view was that reindeer herding was on the brink of collapse (Gundersen and Rysstad 2013; Holand 2003).

In the 1960s herders and representatives from the county of South-Trøndelag met to try to rectify the situation. They agreed upon joint operations led by a board consisting of two herders and a chairman, appointed by the County Governor (Gundersen and Rysstad 2013). The herders accepted official oversight and control. Herders took an active role with the hope that conditions would improve so that the reindeer husbandry could be developed further (Holand 2003). Consequently, during the 1960s reindeer husbandry improved and the number of reindeer increased (Holand 2003).

At the same time, new herders established themselves, further increasing the number of reindeer. Conflicts with landowners convinced herders that a close collaboration was necessary, and consequently, in contrast to the North, they managed to agree on a maximum number of reindeer within the districts because herders with large herds were willing to reduce herd size (Holand 2003). The distribution of reindeer was to be determined by family size, so that multi-generational businesses got more animals, while single herders had to settle for fewer (Holand 2003). A fair—or at least an agreed upon—distribution of animals among families was decisive for fruitful internal collaboration (Holand 2003).

Pressure from farmers increased during the 1970s and 1980s. At this time, the cultivation of new land took place within reindeer herding areas (Gundersen and Rysstad 2013) and to deal with this efficiently it was important for herders to present a common front in opposing the expanding agricultural sector (Holand 2003). A contentious issue was, for example, that herders were, by law, required to stop reindeer from encroaching on cultivated fields. It was thus the herders' obligation to fence in newly cultivated areas and they were liable for (alleged) damages incurred by reindeer (Gundersen and Rysstad 2013).

Through several trials during the 1970s and 1980s, and more recently in 1997, herders in the South lost grazing areas (Holand 2003). For example, the 'Korsøfjell-verdict' from 1988 centred on to what extent herders had rights to winter pastures in the Femund area. The Supreme Court's verdict in the 'Aursund-verdict' of 1997 concerned a disputed area in Røros municipality. Twenty-seven landowners sued herders from one district with respect to illegal grazing on arable land. In the 'Korsøfjell-verdict', the Supreme Court unanimously ruled in favour of the landowners, concluding that a reindeer herding district is not the same as a reindeer pasture area (Gundersen and Rysstad 2013). Similarly, the Court found in the 'Aursund-verdict' that in the specific area—within a designated Saami reindeer herding area—a right to practice reindeer herding was not established (Anonymous 2002). In effect, these verdicts produced a somewhat paradoxical situation whereby Saami herders could lose their right to herd reindeer within a designated reindeer husbandry area, i.e., districts (Gundersen and Rysstad 2013).

This pattern of favouring landowners was, however, to change with the "Selbu-verdict" from 2001 (Anonymous 2002). This case concerned the extension of the right to herd reindeer on private land in Selbu municipality in South-Trøndelag county, and the issue was again tied to areas within already existing reindeer herding districts. The Supreme Court's decision was split 9–6 in favour of the herders, but the minority was—with respect to the essential part—also in favour of the reindeer husbandry (Anonymous 2002). The first-voting minority judge stated that the right to practice reindeer husbandry is an

independent right with a legal basis established through immemorial usage (Anonymous 2002), and moreover, reindeer herding is a legal right, and not just tolerated use (Jonassen and Kalstad 2003). The verdict represents an important victory for Saami reindeer herding in the South (Holand 2003).

In sum, the history of reindeer herding in the South demonstrates that the expanding and legally favoured agricultural sector has encroached upon traditional reindeer areas, which again has led to increased conflict between herders and farmers, i.e., increased inter-group competition (Fig. 3 and S1).

Discussion

Nomadic pastoralism is inherently an expansive adaptation (Paine 1971). Its general characteristics have been described by Hudson (1938): over the course of generations ...

"...the economic pressure of inadequate grazing lands for an increasingly large group sometimes induced an enterprising son of some important family to strike out for himself with his herds, his dependents and other bold or dissatisfied individuals who wished to follow him" (1938:21).

With time, this seceding group comes to consider itself as separate and independent, and eventually the two groups become competitors (Hudson 1938). This pattern points to the important fact for nomadic pastoralists, namely that population growth must be accommodated through expansion of grazing area. Hjort (1981) argues that pastoralism is viable if the population—both human and animal—stays static, or if growth can be met with territorial expansion. Conversely, if grazing areas contract—as with the border closings in the North and the expanding agricultural sector in the South—conflicts arise with other already established groups in the region.

Cultural group selection predicts that competition between groups sustains cooperative norms within groups (Francois *et al.* 2018). It has been suggested that group collective action can be encouraged through emphasising the benefits of within-group coordination in the context of between-group competition (Waring *et al.* 2015; Zefferman 2018,). Waring *et al.* (2015), for example, found that learning between Fijian fishing villages, if strong enough, can overcome the collective action problem within villages. While a fisher might be more successful than his fellow villagers by refusing to adopt sustainable fishing practices, since villages with institutions that encourage more sustainable practices tend to be more successful than villages with fewer, competition between villages is likely a stronger selective force than competition between individual fishers within villages.

The North

Traditionally, winter pastures were informally regulated according to group membership—i.e., Saami reindeer herders had a clear understanding of the fact that different winter pasture areas belonged to different *siidas*, but when in need everybody had right to access alternative pastures (Marin and Bjørklund 2015; Paine 1994; Riseth 2000: 132). Knowledge of *siida* borders was socially transmitted: children most often continued in their parents' *siida*, inheriting rights of occupancy and use (Paine 1994), so neighbours were usually well informed of traditions and rights connected to a specific area such as when it was acceptable to use, and in what ways, pastures of adjacent *siidas* (Riseth and Vatn 2009). Long-enduring use of specific pasture areas thus established reciprocally accepted rights in space and time, with herds on separated pastures in the summer, but on overlapping pastures in winter. There was also an obligation to practise intra- and inter-community mutual aid and reciprocity (Marin and Bjørklund 2015). Furthermore, since the *siida* changed size and composition seasonally herders had potential access to pastures and herding partners over a large area (Marin and Bjørklund 2015). Paine (1994) argues that the three reindeer pasture zones (or ranges) in Kautokeino constituted the primary territorial and social units (neighbourhoods) in which herders lived and moved. The traditional *siida* was also a land tenure institution emphasising flexibility and negotiation. Herders were thus focused on cooperation because "... it is practically important and because every individual's reputation is a powerful asset that allows them potential access to other *siidas*" (Marin and Bjørklund 2015:25). In effect, reindeer herding in the North was characterised by social norms where reciprocal respect and trust between herders was essential and where a breach of social norms was traditionally met by sanctions (Paine 2009; Riseth and Vatn 2009:90).

In 1852, the closing of the border between Finland and Norway limited access to winter pastures forcing adoption of a new pattern of use for remaining pastures in which access and use rights inevitably became a source of conflicts between herders. For example, herders from Kautokeino—being most affected—increased pressure eastward, which decreased the grazing areas available for Karasjok herders (Holand 2003). The fact that in 1871, one exclusive winter pasture area for Karasjok and one for Kautokeino as well as a common 'buffer' area between them was established did not alleviate the conflict; since they were closer to the 'buffer' area and thus could migrate to it earlier than Karasjok herders, the Kautokeino herders appropriated it entirely (Holand 2003).

Access and use rights to winter pastures have been a source of conflict up until very recently; e.g. conflicts between

neighbouring *siidas* with respect to allocation of lichen pastures spiked during the 1980s as expanding *siidas* opportunistically argued—and used—the increasingly official view that autumn and winter pastures were commons (Holand 2003), thus challenging the traditional borders between *siidas* (Holand 2003; Marin 2006; Paine 1994). As Marin (2006) argues, in the absence of a functional alternative regime to the customary tenure system, a *de facto* situation of open access to resources was created.

This situation of physically separated summer districts in combination with more open winter pastures provides a partial answer as to why herding in the North appear to be 'Tragedy of the Commons' (Hardin 1968) as well as why herders have chosen the Pareto inefficient equilibrium of maximising quantity. In effect, the collective aspect of reindeer herding has been undermined at the expense of a free-for-all race in terms of increasing herd size, because herd size determines to a large degree access to pastures (Riseth *et al.* 2004). The multi-level selection framework—where competition between groups is a stronger selective force than competition between individuals—does not work in the North. Hausner *et al.* (2012:2) report that 39 of the 44 summer districts in the North are managed by one *siida*. The remaining five are shared among two or three *siidas*. If we view overstocking as the collective action problem to be solved, the relevant level of organisation whereby between-group competition should have within-group coordinating effects is thus summer districts (or summer *siidas*). Following the logic of group selection, a herder might be more successful than his fellow herders if he refuses to adopt sustainable herding practices (for example, adding additional animals on pastures while his fellow herders do not). However, districts with norms encouraging herders to adopt sustainable practices will tend to be more successful than districts where fewer adopt them (e.g., herds and herders in such districts buffers environmental risk better by adopting a strategy focusing on livestock quality) and thus be emulated by others. In effect, competition between summer districts should work as a stronger selective force than competition between individual herders within districts. The problem is, however, that the cooperative and competitive aspects of herding change during winter: winter *siidas* are smaller than summer districts and summer *siidas*, and might not even be composed of the same people. In the North, the five largest winter pastures encompass 11–21 *siidas*, whereas the five smallest winter pastures are managed by one to six *siidas* each (Hausner *et al.* 2012:2). Thus, any within-district coordinating effects of between-district competition during summer break down during winter.⁷

⁷ This might change: the Norwegian government is in the process of initiating a redistribution of the winter pastures of individual *siidas* to reduce the role of both governmental and regional management. In principle, this redistribution is reinstating power to the traditional Saami *siida* system by giving *siidas* exclusive user rights to geographical delineated winter areas (cf. Næss 2017).

While this situation may have the appearance of a classic ‘Tragedy of the Commons,’ it is more fruitfully viewed as an ‘Assurance game’ where herders have coordinated around the Pareto inefficient solution due to historical perturbations that have increased intra-group competition and decreased trust. A Pareto inefficient equilibrium is maintained because when first established no-one can do better by unilaterally switching strategy (Fig. 1C).

The South

Prior to the Reindeer Husbandry Law of 1933, reindeer herding in the South operated under the ‘Common Lapp Law’ from 1883. This law imposed strong obligations on the Saami in relation to farmers: §6 states among other things that grazing areas could be separated into districts and the Saami were responsible for damages by reindeer incurred on properties of the farming population (Fjellheim 1999). Furthermore, the district designation also encompassed areas where herders had no customary user rights—in effect the district areas were larger than areas perceived as traditional pastures—because of a strong desire to include a larger area in the existing joint district liability for damages incurred by farmers from reindeer (Gundersen and Rysstad 2013).

Because of the expanding agricultural sector, reindeer herding in the South has been in intense competition for land with the farming population. Turchin and Gavrillets (2009) describe farmer-herder relationship as ‘metaethnic:’ when competitors belong to different metaethnic communities, they argue, the intensity of conflicts is often amplified. Competition (especially warfare) has been argued to be a major factor in e.g., political evolution (cf. Carneiro 1970; Turchin 2007; Turchin and Gavrillets 2009). Conflict and competition are, however, insufficient: its evolutionary impact hinges on the relationship between population density and resources. A common response to conflict where there is low population density is to move away from contested areas to locations where unused and unclaimed resources are available. As populations grow, however, more and more of the available resources are used and unused resources become difficult to locate, consequently reducing the usefulness of mobility as an alternative to open conflict (Irons 1979).

In the aftermath of the conflicts in 1794 and 1801, for example, one *sijte*—consisting of two herding families—tried to relocate. While the underlying reason is unknown, it was most likely an attempt to avoid conflicts with farmers. However, this strategy did not work since 40–50 armed farmers arrived at their new location and slaughtered 392 reindeer⁸ and chased the herders themselves away, leaving them

dependent on public support and with a few reindeer (Fjellheim 1999; Løøv 1994). While the farmers were subsequently prosecuted, convicted, and sentenced to pay the herders compensation, the settlement had one important caveat: the Saami herders had to vacate the area (Fjellheim 1999).

From the end of the Second World War until the 1970s the prevailing view was that reindeer herding was on the brink of collapse (Gundersen and Rysstad 2013; Holand 2003). Continued pressure from farmers necessitated the herders to present a common front (Holand 2003). Several trials during the 1970s, 1980s, and in 1997 resulted in a loss of grazing areas (Holand 2003). According to Riseth and Vatn 2009, farmer pressure was a key factor for the political organisation of the South Saami in the early 1900s. The first Saami national congress, held in Trondheim in 1917, gathered many South Saami and just a few from the North; Saami from the South were consulted by the Government; in short Saami in the South were more politically active than the Saami in the North (Riseth and Vatn 2009). As previously noted, during the 1960s the reindeer husbandry in the South improved, and the number of reindeer increased (Holand 2003). One reason for this was that the herders in the South lobbied politicians to appoint professional agronomists in two vacant Saami Bailiff posts in 1969 and 1973 to advance changes related to calf slaughter (Riseth and Vatn 2009).

Calf slaughter can be a strategy to increase livestock quality: Mace (1993) found, for example, that among the Gabbra (pastoralists in northern Kenya herding sheep, goats, and camels), wealthy herders control the breeding rates of livestock because it extends the longevity of females. The underlying rationale is linked to the cost of reproduction, especially during occasions of harsh weather conditions when survival rate of neonates and even pregnant and/or lactating females can be substantially lowered (cf. Bårdsen *et al.* 2010). A herder can reduce this cost by controlling breeding rates (Mace 1993) or by slaughtering calves (Næss *et al.* 2012). Herders and the reindeer husbandry management authorities succeeded in developing sufficient mutual trust as a basis for cooperation, and when a calf slaughter subsidy was implemented in 1977 as part of the agreement with the Norwegian state, many herders in the South were ready and quickly adopted this way of harvesting (Riseth and Vatn 2009). In short, in the South the Saami not only participated in reindeer husbandry management but were in many cases themselves behind the institutional changes implemented by the authorities (Riseth and Vatn (2009). Consequently, the new policies were well fitted to changes the Saami themselves were advocating, turning their focus towards increased meat production rather than herd accumulation (Riseth and Vatn 2009).

Concluding Remarks

The main point I wish to stress in this paper is that reindeer herding in Norway can be viewed as an assurance

⁸ Interestingly, 304 reindeer belonged to the Saami while 84 were in their custody and owned by peasants and officials (Løøv 1994:167), an indication that herder-farmer relationships were not always antagonistic.

game with two possible equilibria: increasing livestock quantity or quality. Instead of viewing increased quantity as an example of a ‘Tragedy of the commons’ or as a natural outcome of a non-equilibrium system, this perspective broadens our understanding of pastoral strategies by viewing them as an outcome of historical perturbations affecting the evolution of prevalent norms. Norms provide people with focal points around which to coordinate behaviour (Schelling 1980). Competition between different groups has been argued to shape normative content (Boyd *et al.* 2018) and the selection of herd accumulation in the North and livestock body mass in the South could thus be viewed as a response to competition. Herders in the North have competed mainly against each other while herders in the South have a history of competition against farmers. It could thus be argued that a history of inter-group competition in the South has coordinated herders around the strategy of increasing livestock quality. Increasing livestock body mass also decreases herd expansion and thus limits the potential for encroaching on surrounding farming land, i.e., it reduces the potential for inter-group conflicts. In contrast, a history intra-group competition in the North has resulted in herd accumulation as the preferred strategy. While this strategy translates into territorial expansion and thus increases intra-group conflicts, herd size is a measure of power: herd size determines to a large degree access to pastures (Riseth *et al.* 2004). Both strategies are, however, best viewed as ways to achieve the ultimate goal of long-term survival (Dyson-Hudson 1977) in the contexts of different historical and social environments.

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Compliance with Ethical Standards

Conflict of Interest The author declares he has no conflicts of interest.

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